

“It all Begins with Wheat...”





Wheat Classes

Hard Red Winter



The dominant class in U.S. exports and the largest class produced each year. Produced in the Great Plains states, a large interior area extending from the Mississippi River west to the Rocky Mountains and from Canada to Mexico. Wide range of protein content, good milling and baking characteristics. Used to produce bread, rolls and, to a lesser extent, sweet goods and all-purpose flour. Major foreign buyers include Russia, China, Japan, Morocco and Poland.

Hard Red Spring



Contains the highest percentage of protein, making it an excellent bread wheat with superior milling and baking characteristics. Majority of crop is grown in Montana, North Dakota, South Dakota and Minnesota. Exported largely to Central America, Japan, the Philippines and Russia.

Soft Red Winter



Grown primarily east of the Mississippi River. High yielding, but relatively low protein. Used for flat breads, cakes, pastries, and crackers. Largest customers are China, Egypt and Morocco.

Wheat Classes (continued)

Durum Wheat



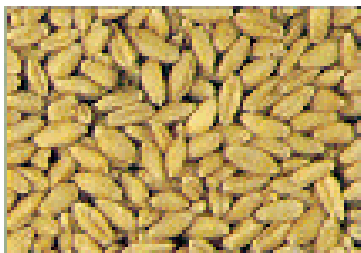
The hardest of all U.S. wheat and consistently the class with the lowest export volume, accounting for less than 5 percent of all U.S. wheat exports. Grown in the same northern states as Hard Red Spring, although 70 to 80 percent of the U.S. annual production comes from North Dakota. Used to make semolina flour for pasta production. The largest importer is Algeria.

Hard White Wheat



The newest class of wheat to be grown in the United States. Closely related to red wheats (except for color genes), this wheat has a milder, sweeter flavor, equal fiber and similar milling and baking properties. Used mainly in yeast breads, hard rolls, bulgur, tortillas and oriental noodles. Used primarily in domestic markets, although it is exported in limited quantities.

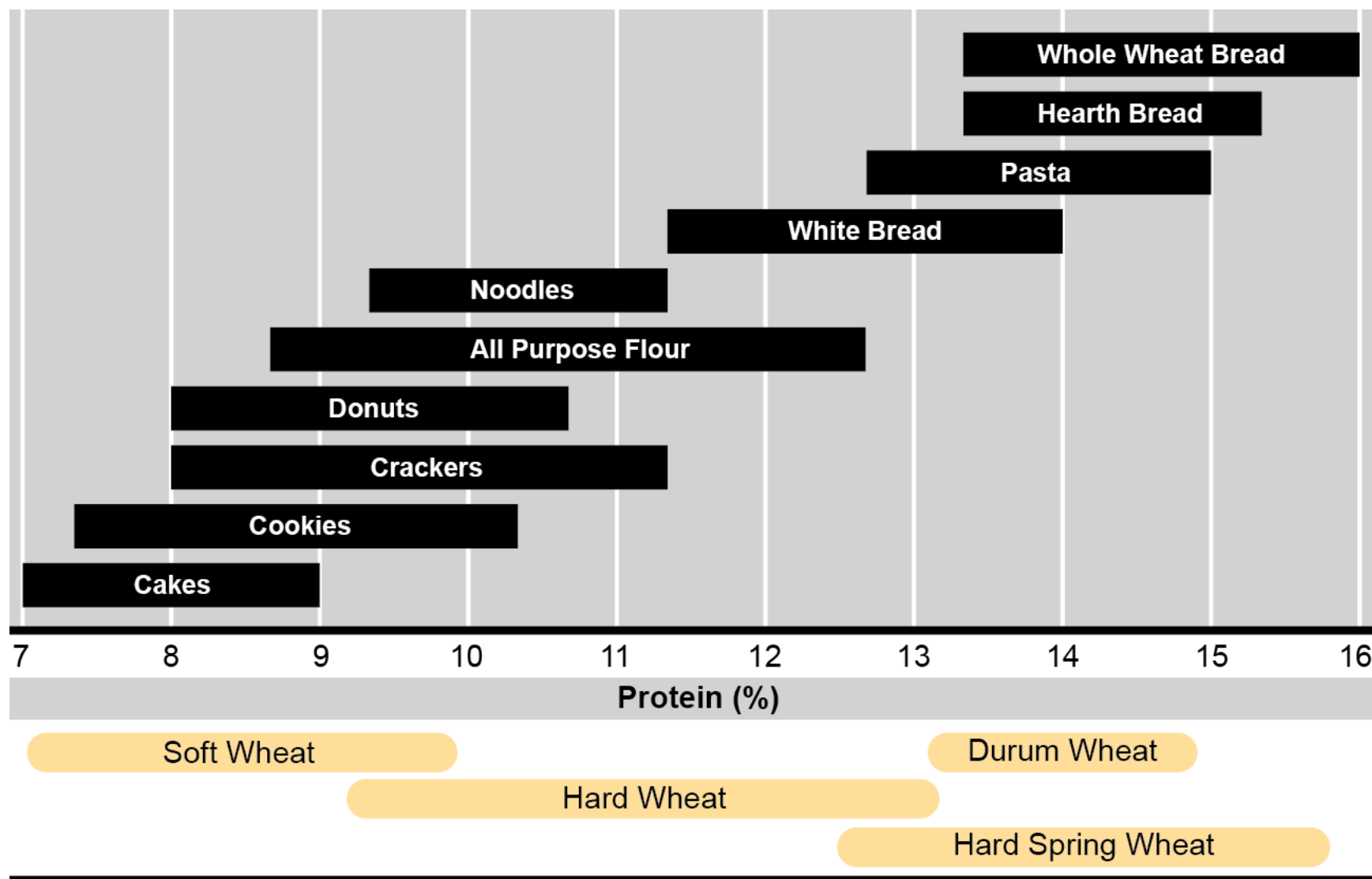
Soft White Wheat



Used in much the same way as Soft Red Winter (for bakery products other than bread). Grown mainly in the Pacific Northwest and to a lesser extent in California, Michigan, Wisconsin and New York. Low protein, but high yielding. Produces flour for baking cakes, crackers, cookies, pastries, quick breads, muffins and snack foods. Exported to Far East Asian region.

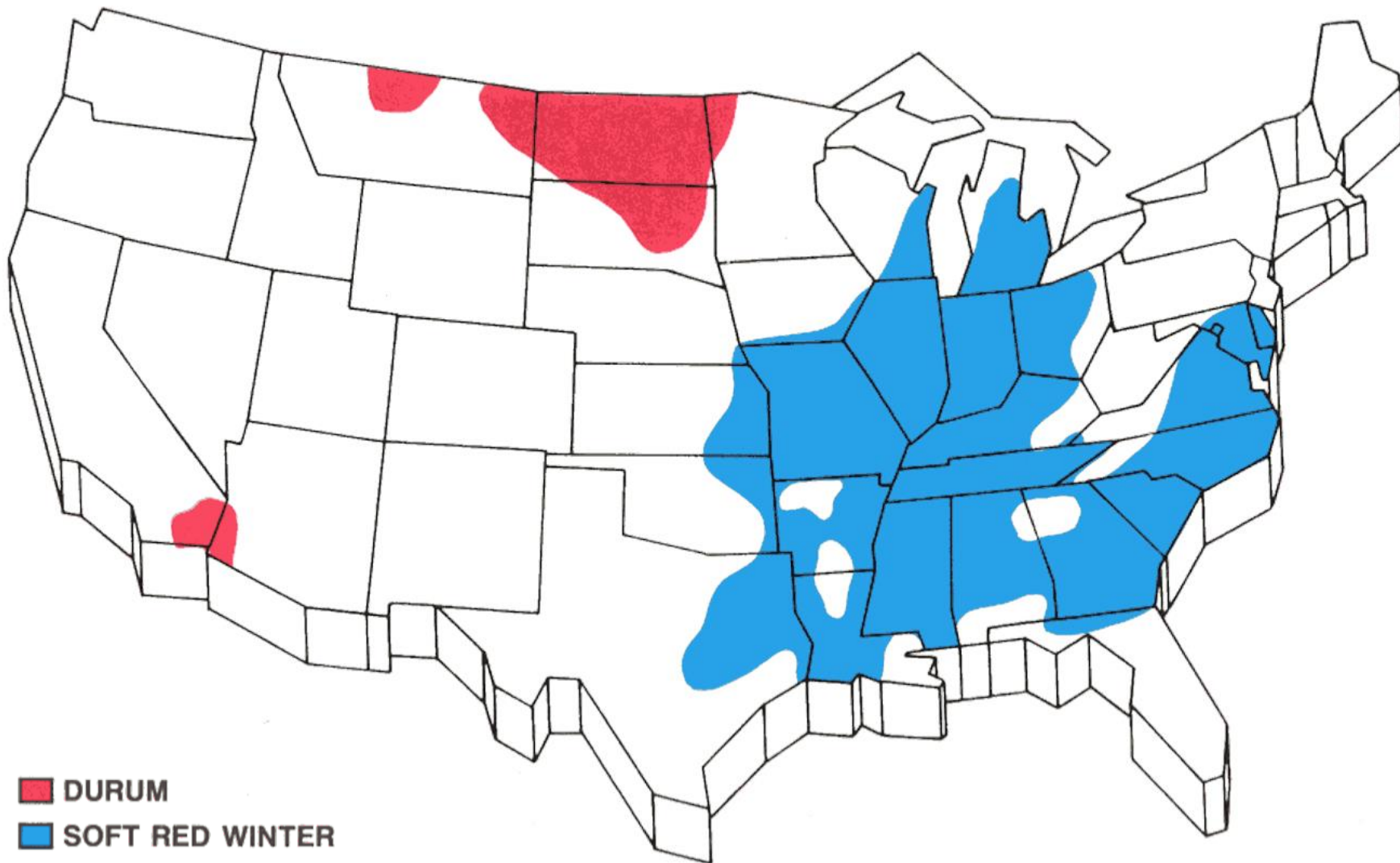


Protein Ranges





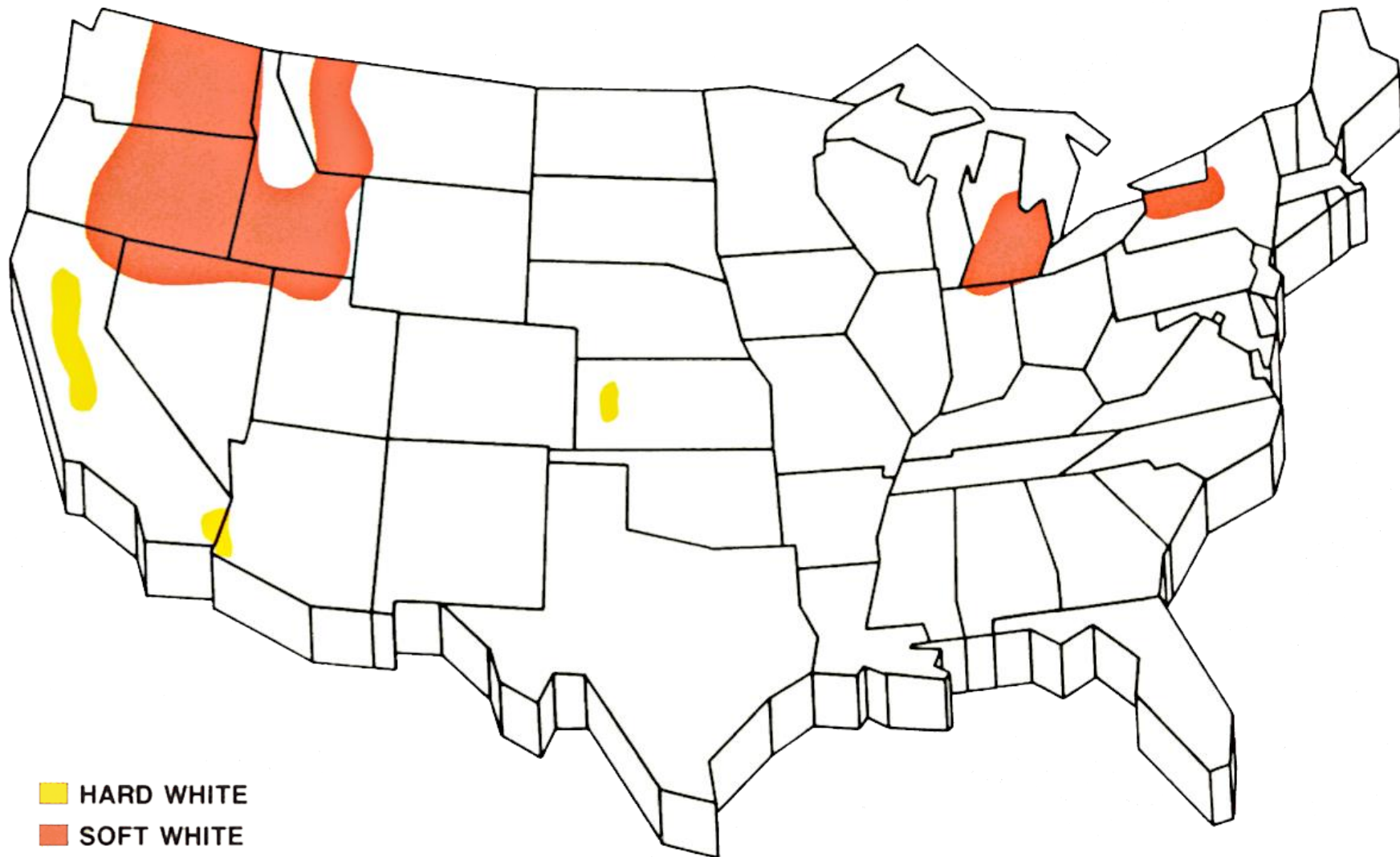
Durum and Soft Red Winter Wheat Growing Region





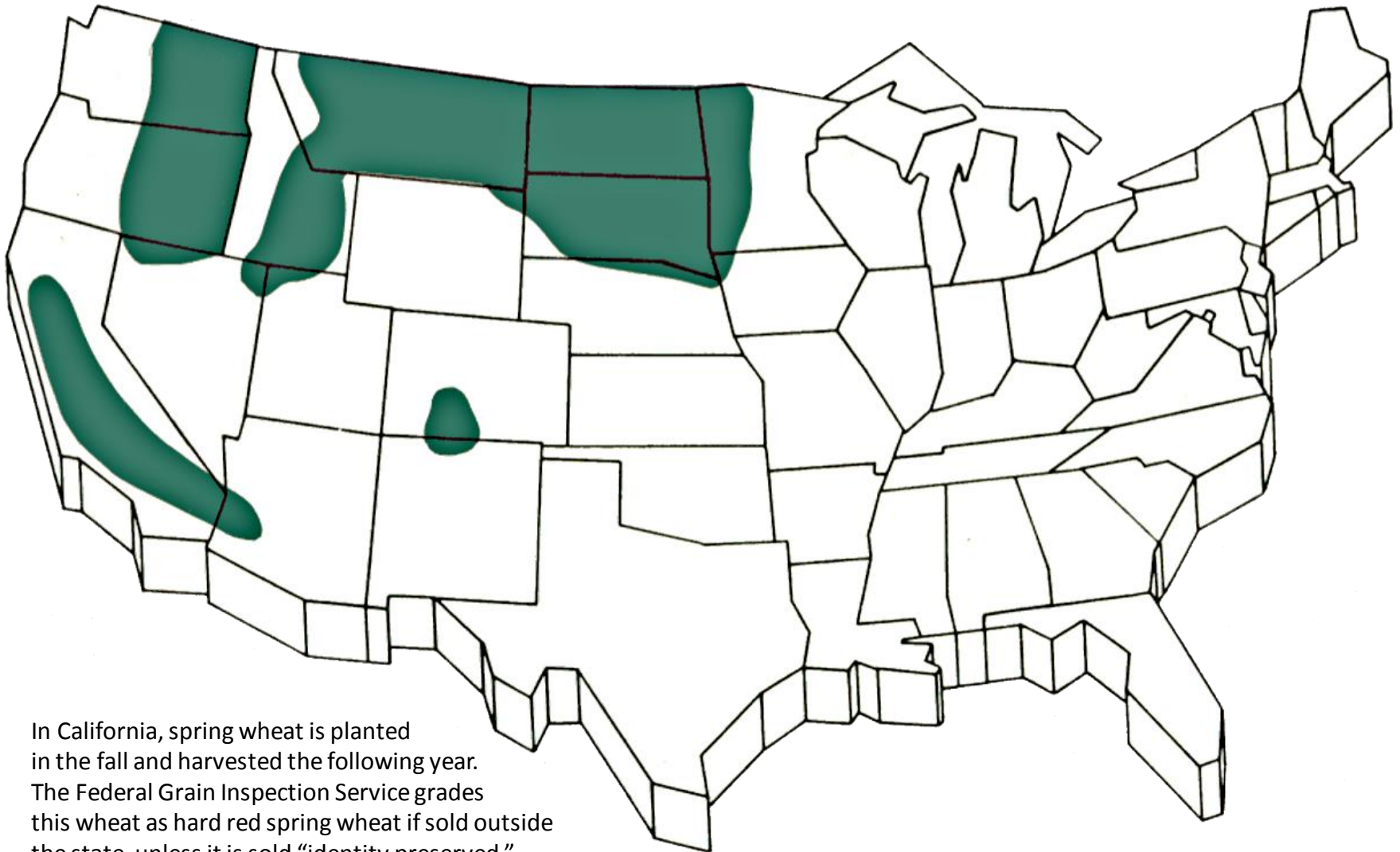


Hard and Soft White Wheat Growing Region





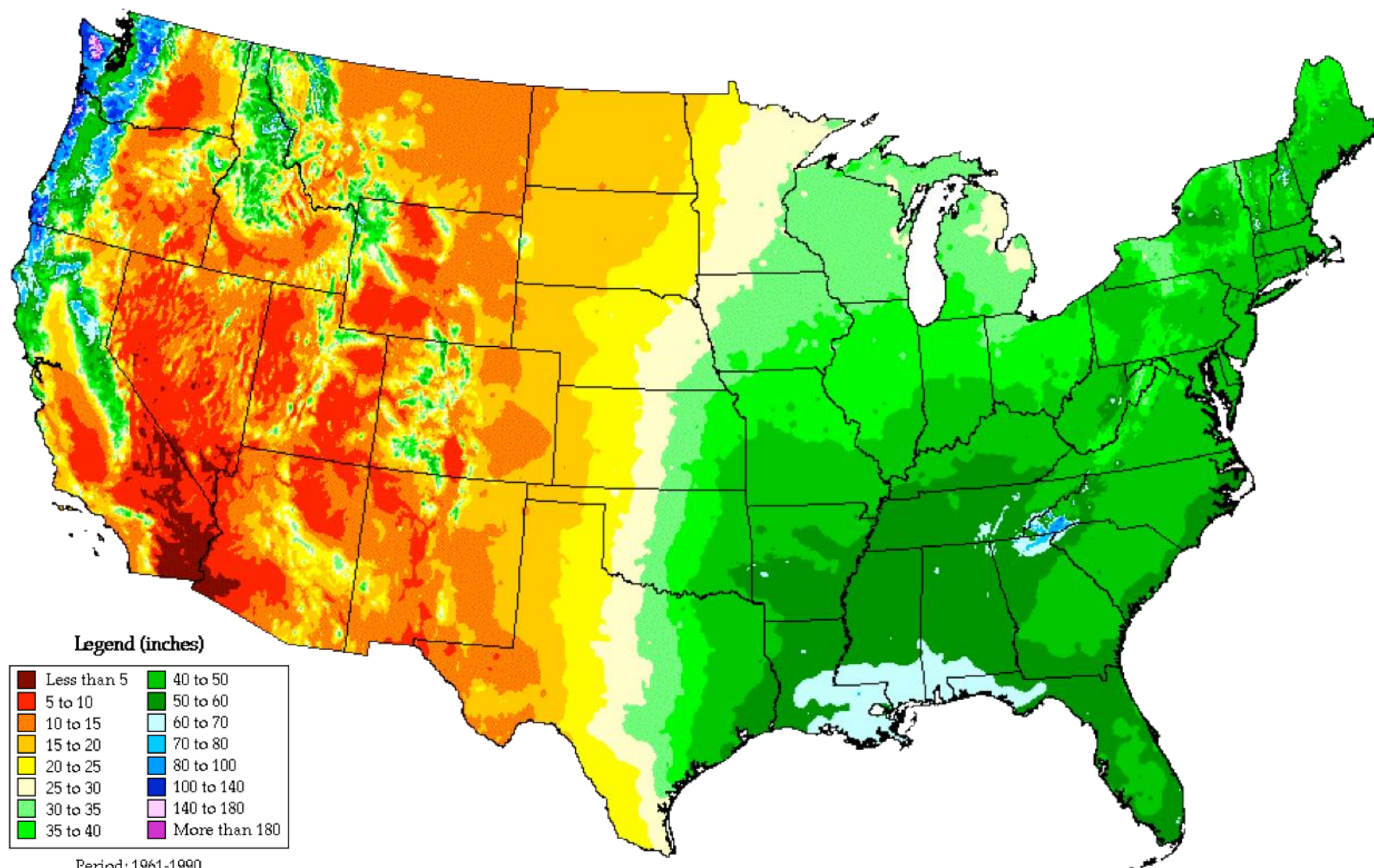
Spring Wheat Growing Region



In California, spring wheat is planted in the fall and harvested the following year. The Federal Grain Inspection Service grades this wheat as hard red spring wheat if sold outside the state, unless it is sold "identity preserved."



Annual Average Precipitation





Field Issues Affecting Grain Quality



Freeze Injury



Fusarium Head Blight



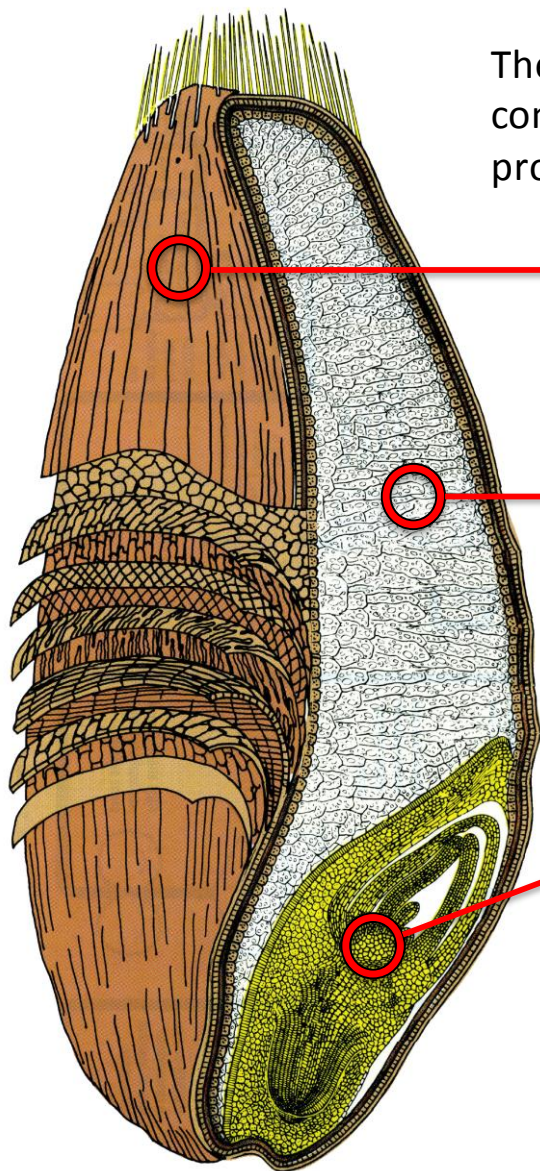
Army Worms



Sprouting

Kernel of Wheat

The kernel is the seed from which the wheat plant grows. Each seed contains three distinct parts which are separated during the milling process to make flour.



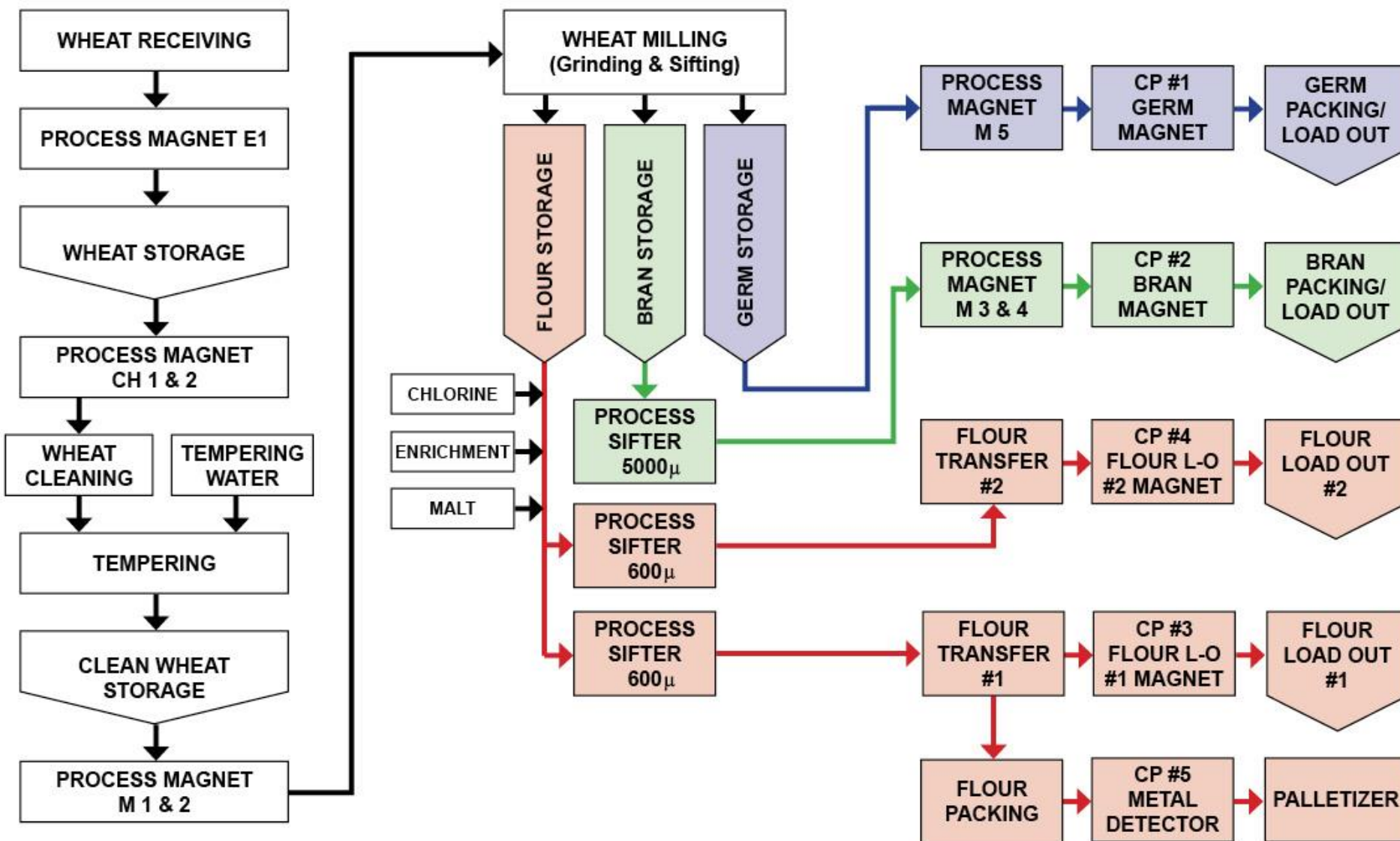
○ **Bran** – 14.5% of the wheat kernel. Contains a small amount of protein, a large quantity of the major B vitamins, trace minerals, and dietary fiber – primarily insoluble.

○ **Endosperm** – 83% of the wheat kernel and is the source of white flour. Contains the greatest share of protein, carbohydrates and iron, as well as the major B Vitamins. Also a source of soluble fiber.

○ **Germ** – 2.5% of the wheat kernel. This is the embryo, or sprouting section of the seed. The germ is often removed from the flour in the milling process due to its high fat content, which limits shelf life. Contains a small amount of high quality protein, and a larger amount of B vitamins and trace minerals.

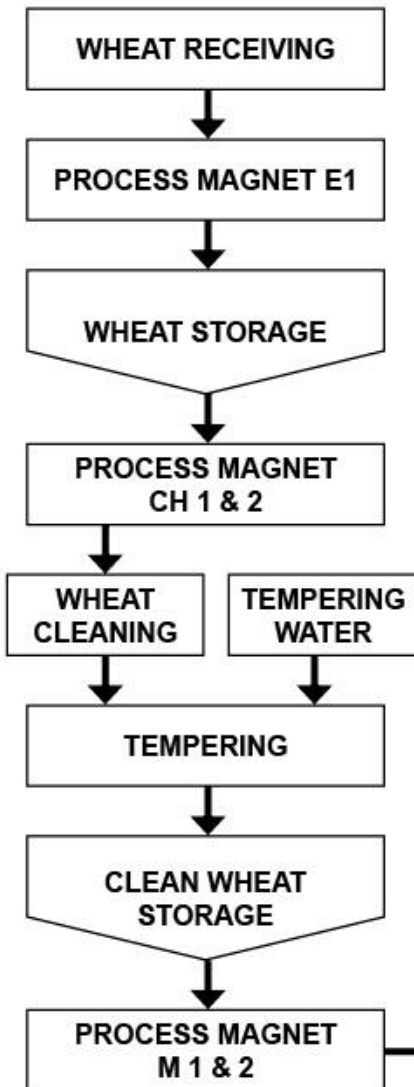


Simplified Mill Process Flow

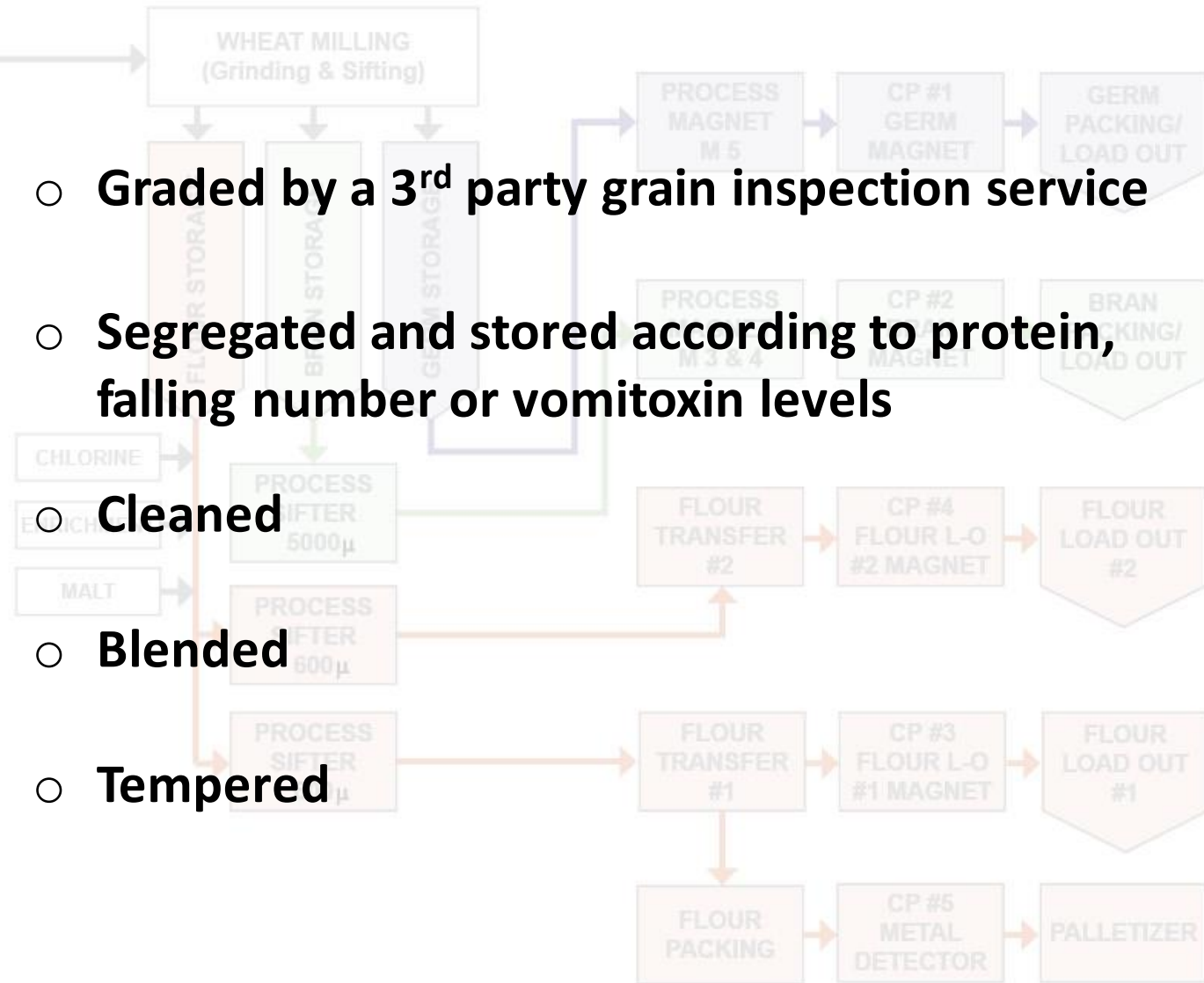




Wheat Handling



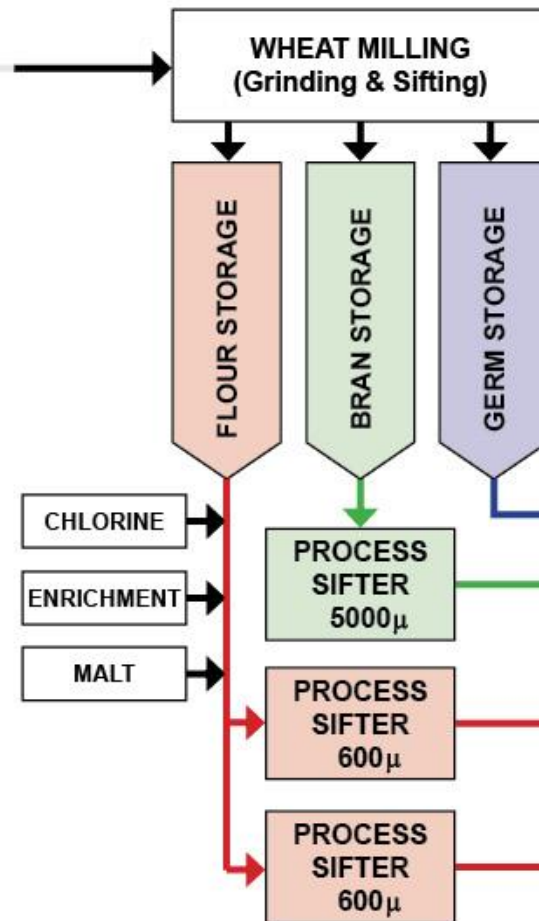
- Graded by a 3rd party grain inspection service
- Segregated and stored according to protein, falling number or vomitoxin levels
- Cleaned
- Blended
- Tempered





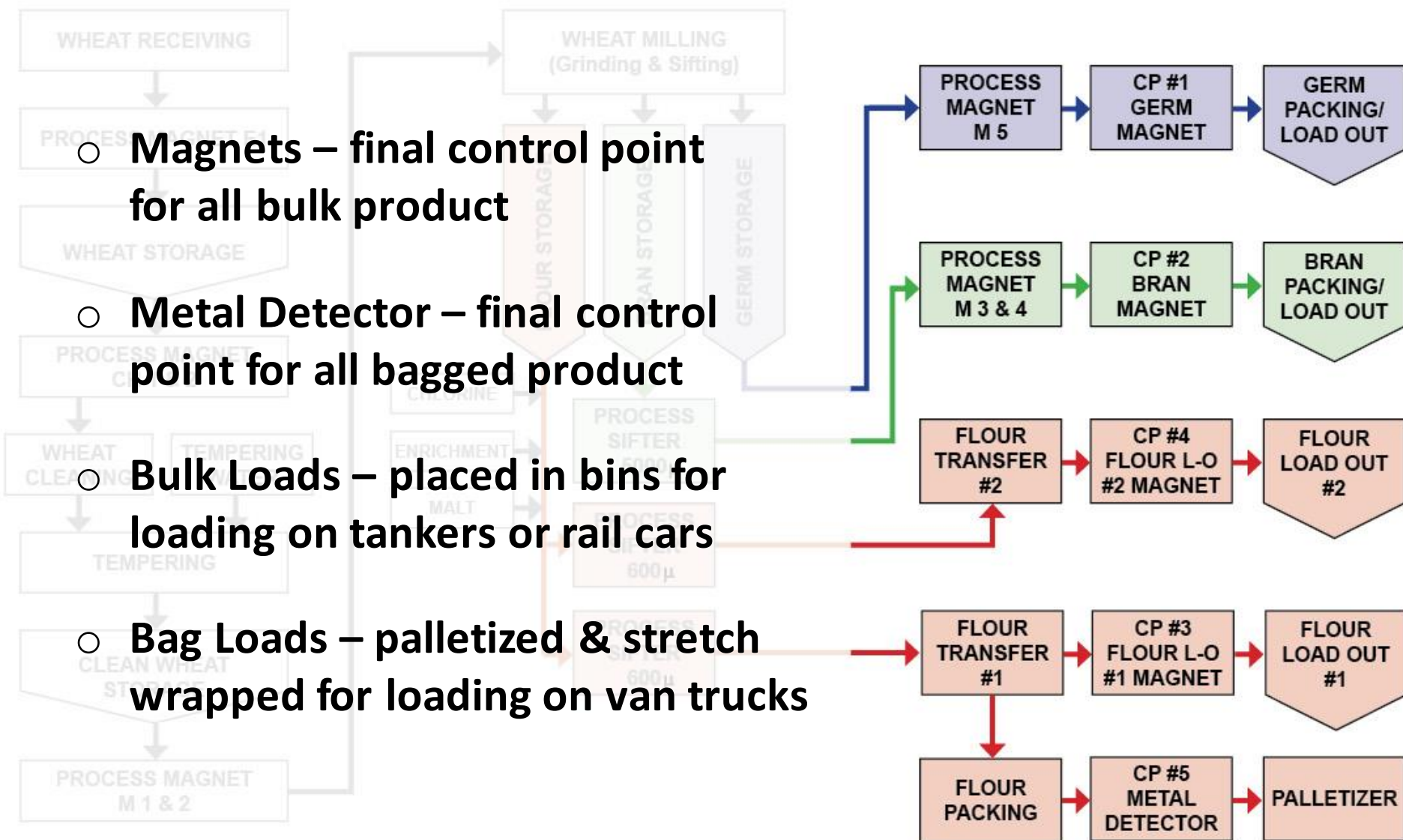
Milling Process

- Milled to customer specs
- Ingredients added per specs
- Sifted
- Infestation Destroyer



Food Safety, Packaging & Loading

- Magnets – final control point for all bulk product
- Metal Detector – final control point for all bagged product
- Bulk Loads – placed in bins for loading on tankers or rail cars
- Bag Loads – palletized & stretch wrapped for loading on van trucks





Protein Content

Wheat Protein is Affected By:

- Variety
- Environmental Conditions
- Available Soil Nitrogen
- Nitrogen Applications



Flour Protein is Affected By:

- Wheat Tempering
- Milling Changes
- Wheat Blends
- Streams Selection



Flour Treatment

- Chlorine
- Benzoyl Peroxide
- Enrichment
- Malt
- Ascorbic Acid





Flour Treatment

- **Chlorine**
 - Lowers pH
 - Reacts with the Starch, Proteins & Lipids
 - Lightens Color
 - Weakens Proteins
 - Tightens Cookie Spread
 - Reduces Batter Viscosity
- Benzoyl Peroxide
- Enrichment
- Malt
- Ascorbic Acid





Flour Treatment

- Chlorine
- **Benzoyl Peroxide**
 - Removes Color Pigment
 - Does not Affect Flour Characteristics
 - Does not Lower pH
- Enrichment
- Malt
- Ascorbic Acid





Flour Treatment

- Chlorine
- Benzoyl Peroxide
- **Enrichment**
 - Added to meet FDA Requirements
 - ✓ 2.9 mg Thiamin
 - ✓ 1.8 mg Riboflavin
 - ✓ 24.0 mg Niacin
 - ✓ 20.0 mg Iron
 - ✓ 0.65 mg Folic Acid
- Malt
- Ascorbic Acid





Flour Treatment

- Chlorine
- Benzoyl Peroxide
- Enrichment
- **Malt**
 - Adds Amylase Enzymes
 - Will Lower Viscosity
 - Reacts with Damaged Starch in the Baking Process
- Ascorbic Acid





Flour Treatment

- Chlorine
- Benzoyl Peroxide
- Enrichment
- Malt
- **Ascorbic Acid**
 - Reducing Agent
 - Dough Conditioner
 - No usage limit in USA, but little functional benefit above 150 ppm





Soft Wheat Flour Applications

- Cakes
- Cookies , Crackers and Pastries
- Pretzels, Batters and Breadings





Soft Wheat Flour Applications

○ Cakes

- Hi Ratio Cakes – sugar content is great than flour content
- Higher protein gives a larger and coarser cell structure
- Lower protein gives tender cakes

○ Cookies, Crackers and Pastries

○ Pretzels, Batters and Breadings



Soft Wheat Flour Applications

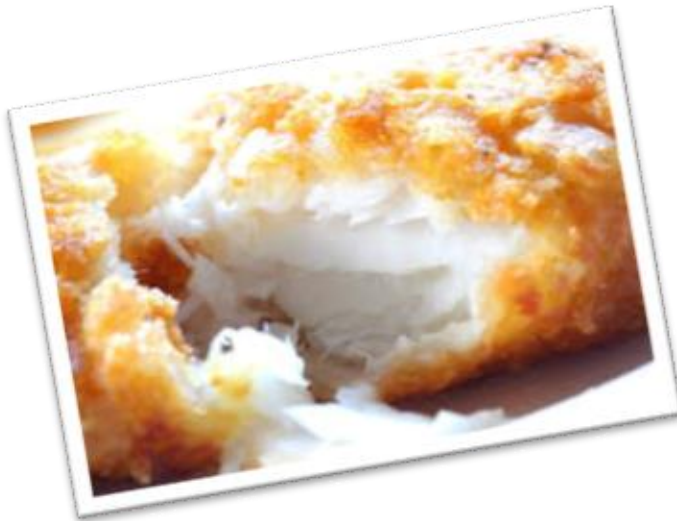
- Cakes
- **Cookies, Crackers and Pastries**
 - The higher the ash content, the lesser the spread.
 - Flour granulation also affects the spread.
 - Chlorine tightens the spread.
- Pretzels, Batters and Breadings





Soft Wheat Flour Applications

- Cakes
- Cookies, Crackers and Pastries
- **Pretzels, Batters and Breadings**
 - Can use a higher ash flour



Whole Wheat Flour

- Made with all flour streams combined
- Includes all flour, bran and germ
- Granulation can vary
- Will need to adjust water in formula when replacing white flour





Analytical Tests

- Moisture
- Protein
- Ash
- pH
- Falling Number
- Vomitoxin
- Solvent Retention Capacity (SRC)





Analytical Tests

- **Moisture**
 - Typical range is 12-14%
 - Dried cake flour is 9-11%
- Protein
- Ash
- pH
- Falling Number
- Vomitoxin
- Solvent Retention Capacity (SRC)





Analytical Tests

- Moisture
- **Protein**
 - Cake Flour: 6.5 – 8.5%
 - Pastry Flour: 7.0 – 9.0%
 - Bread Flour: 10.0 – 11.5%
- Ash
- pH
- Falling Number
- Vomitoxin
- Solvent Retention Capacity (SRC)





Analytical Tests

- Moisture
- Protein
- **Ash**
 - Sample is incinerated
 - Measures mineral content
 - Cake Flour: .34 - .42%
 - Pastry Flour: .43 - .52%
- pH
- Falling Number
- Vomitoxin
- Solvent Retention Capacity (SRC)





Analytical Tests

- Moisture
- Protein
- Ash
- **pH**
 - Unchlorinated: 6.0 – 6.4
 - Chlorinated: 3.9 – 5.9
 - Cake flour: 4.3 – 4.7
- Falling Number
- Vomitoxin
- Solvent Retention Capacity (SRC)





Analytical Tests

- Moisture
- Protein
- Ash
- pH
- **Falling Number**
 - Measures alpha amylase activity
 - Indicator of sprout damage
- Vomitoxin
- Solvent Retention Capacity (SRC)





Analytical Tests

- Moisture
- Protein
- Ash
- pH
- Falling Number
- **Vomitoxin**
 - Toxic chemical produced by a mold
 - FDA guideline is 1 ppm for human consumption
- Solvent Retention Capacity (SRC)





Analytical Tests

- Moisture
- Protein
- Ash
- pH
- Falling Number
- Vomitoxin
- **Solvent Retention Capacity (SRC)**
 - Water - overall absorption
 - Sodium Carbonate – starch damage
 - Lactic Acid – protein quality
 - Sucrose - pentosans

